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NEW PRESIDENT—NATIONAL VETERINARY MEDICAL ASSOCIATION

We would add our congratulations to Walter Reginald Wooldridge, M.Sc., Ph.D., M.R.C.V.S., the recently elected President of the National Veterinary Medical Association. Dr. Wooldridge is well known to many readers of The Veterinary Journal in this and other countries, either personally or through the many interests he has in the affairs of the veterinary profession. His experience both in scientific and political matters well fits him to occupy the high position which he has now attained; the N.V.M.A. is to be congratulated on its choice.

Dr. Wooldridge has had a varied and distinguished career. Beginning as a student in the Royal Veterinary College and at the same time at Birkbeck College of the University of London he obtained the B.Sc. degree with honours in Chemistry and the Diploma M.R.C.V.S. He was awarded a Ministry of Agriculture Research Scholarship and worked at the University of Cambridge mostly under the direction of Sir Frederick Gowland Hopkins and the late Sir William Hardy. He was a Frank Smart student at Gonville and Caius College, Cambridge, and later was awarded a Beit Memorial Fellowship for Medical Research. On leaving Cambridge he was appointed to the post of Demonstrator in the Division of Biochemistry at the London School of

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Hygiene & Tropical Medicine and later became a Lecturer in the same subject, a post which he still occupies.

As a research worker Dr. Wooldridge has carried out some important fundamental work, the nature of which may not be entirely appreciated by other than workers in the same field. He has been concerned chiefly with a study of the bacterium and its own intimate life and has included work on enzymic actions. All of this has a close bearing on the physiology of animal tissues.

Dr. Wooldridge has also taken a leading part in the various activities of the veterinary profession and has been, and still is, a member of some of the important Committees and Associations whose work and decisions have an important influence on the welfare of the profession.

General Articles

EPIZOOTIC LYMPHANGITIS

By ZAKI MORCOS, M.V.Sc., F.R.C.V.S., D.V.H.
Cairo Veterinary School.

Literature

ACCORDING to Gaiger and Davies (1932), epizootic lymphangitis is an equine disease caused by a cryptococcus which stains readily when a mordant is applied, grows very slowly, at least four weeks passing before colonies make their appearance, horse dung agar covered with a film of macerated equine lymph gland being necessary for successful growth.

Colonies become firm and when aged wrinkled, white flakes develop on liquid media at the bottom of the culture tube; virulence is retained on culture media.

The organism was isolated from the lesions spreading via lymphatics and only very rarely it became metastatic.

The lesions were confined to the cording of lymph vessels and the appearance of nodules along the inflamed lymph vessel when an ulcer formed as the nodules burst. Ulcers were of obstinate healing nature. Hutyra and Marek (1926) prefer staining the sacchromyces equi with Mann's or Weigert's stain; cultivation was carried out as with Gaiger and Davies but cultures on liquid media are described as a membrane on the surface of the tube. Both authors failed to reproduce the disease by artificial inoculation of the pus into or under the skin of horses and mules and only on rare occasion a nodule developed locally and healed spontaneously. They also recorded cases among cattle in Japan and say that man may even become infected. Recovered animals acquire a long-standing immunity. Bennett (1932) recorded a heavily infected aged horse in Sudan and described the presence of hyphæ of cryptococcus farciminosus; the lesions, in addition to spreading all over the skin, reached the nostrils and extended into the sinuses, lungs and adjacent lymph glands. In the *Annual Veterinary Report of Sudan* (1933) partial success in treatment with mercuric and potassium iodides in maximal doses both per os and intravenously is recorded. Nori (1933) attempted the treatment of cases biologically, using subcutaneous injections of small doses of a suspension of disintegrated pathological tissue from field cases of the disease; "isopatin" was the name given to the product, the use of which produced encouraging results. Iyer (1936) reported an unusual case of epizootic lymphangitis in a

mule in which the lesions were only seen on P.M. in the intestines and mesenteric glands, indicating infection per os. Bowhill (1902) recorded infection via wounds or abrasions resulting in suppuration of the superficial lymphatics, the period of incubation being three months or longer. He described the organism as a double contoured cell, developed by budding, difficult to stain; it resisted 5 per cent. carbolic acid solution but was destroyed when heated at 80 deg. Cent. The medium was made of horse serum to which glucose, glycerine and cane sugar were added in 2 per cent. quantities. Horses, mules and cattle were reported as susceptible. Kelser (1927) gave a full account of the mode of infection and the staining of the organism. He found that Gram's method gave excellent results. Growth took place after a very long period, about 40 days elapsing before it could be detected at 37 deg. Cent. or at room temperature; on ordinary media, in most cases growth failed; potato media were found to be suitable. The organism was not easily affected by antiseptics, dryness, light or temperature. *Inoculated guinea pigs develop lesions in the regional lymph glands. Inoculation of rabbits occasionally result in the formation of an abscess at the point of inoculation.* Herzog (1910) described the organism and its slow growth on culture media when filaments or oblong cylindrical cells were found. Buchanan (1922) found potato to be the most suitable media for growth at 25-28 deg. Cent. No toxins were demonstrated but the Widal test revealed the presence of agglutinins; methods of immunisation were not successful.

Experimental

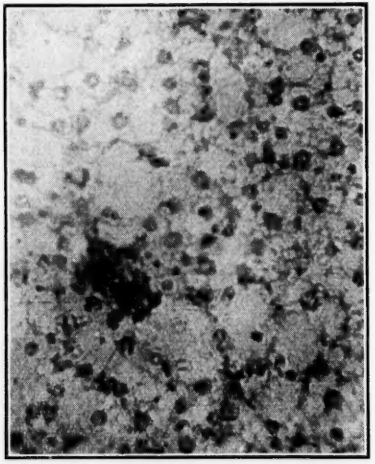
CASE I.

A bay filly, six months old, was examined on December 11, 1940. Ulcers were seen along the hind heels of both hind limbs, superficial looking, raw and ragged. Ulcers were also found along the whole anus between perineal and mucous membrane, as well as along the inferior surface of the nasal orifices at the junction of the skin and mucous membrane; one ulcer about half an inch in diameter was found exteriorly under the near hock. None of the lymph vessels were distended. There was no temperature; the appetite was fairly good. *The Mallein test gave a negative result.*

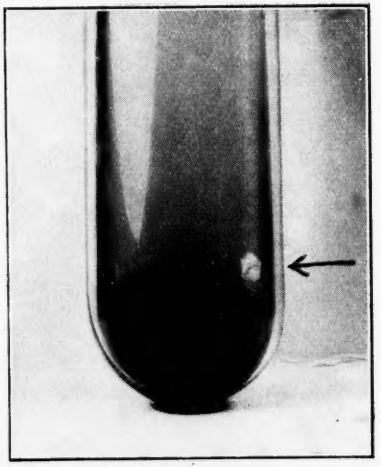
Films were prepared from every ulcer separately. All fresh preparations revealed oval double-contoured cells 2-4 microns in diameter; daughter budding cells were occasionally seen but *no filamentous forms were found.*

All the stains tried did not show the double contour except in occasional cells. Gram's method gave good results but did not reveal the double contour. Metam's method was also used except that instead of Kuhen's iodine, Gram's iodine was used so as not to expose preparations too long to absolute alcohol.

Scrapings from ulcers were soaked in 70 per cent. alcohol for 15 to 20 minutes or rabbit's or guinea pig's juice from enlarged abdominal lymph



(Eye Piece x 10, objective 1/12-inch.)
Smear from abdominal lymph gland of guinea pig 40 days after injection.



Culture (normal size).
Horse lymph gland, agar medium, 60 days old, incubated at 17 deg. Cent.

glands, and were seeded on large tubes (double the size of ordinary tubes) containing the following culture media :—

1. Potato.

2. Agar media (meat was substituted for macerated horse lymph gland and water contained soaked filtered horse fæces).

3. Litmus milk agar (2 per cent. agar in milk just coloured blue with litmus).

4. Solidified serum media.

5. Egg media.

Tubes were inoculated and incubated at 37 deg. Cent. and at room temperature (17-20 deg. Cent.). Growth appeared only on about 15 per cent. of the macerated horse lymph gland media incubated at *room temperature* after 60 days and was raised, wrinkled, pale yellow in colour after three months, crumbled on touching with a platinum loop. No growth took place on any of the other culture media.

Films of the culture revealed double-contoured cells *but no filamentous forms.*

Emulsions of ulcer of scrapings and culture were inoculated intraperitoneally separately into (a) desert mice, (b) guinea pigs and (c) rabbits.

The animals were chloroformed after 40 days and post-mortem examinations revealed *abdominal lymph glands* softened and enlarged five to seven times the normal size and very rich with sacchromyces equi (cryptococcus) single cells but no filamentous forms. *No suppuration of the animals' lymph glands was seen at this stage.*

This case was treated (ulcers painted twice daily with an ointment called *"Pellidol Bayer"* by the school infirmary surgeon) and recovered.

Case II.

Pus smears were taken from a mule by a British Army veterinarian and when examined were found to be rich in cryptococci, both extra- and intracellular forms being present. The animal was destroyed immediately on diagnosis.

Summary

1. A practical method for confirming the existence of epizootic lymphangitis is the intraperitoneal inoculation of ulcer scrapings or pus into *rabbits*, the carrying out of a post-mortem examination after 40 days and the examination of the lymph glands.

2. To see the double contour fresh preparations are essential.

3. In every case the animal must be tested with Mallein before confirmatory diagnosis is reported, more so as a double infection may not be uncommon.

4. Rabbits are the most susceptible among laboratory animals and the peritoneal route of injection yields best results.

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FOR THE BENEFIT OF THE STATE

By J. McCUNN

An epoch-making occasion occurred in 1941. It coincided with the issue of Army Order No. 1 of 1941. This Order provided for the amalgamation of the Remount Services with the Army Veterinary Service. In short, the Army Veterinary Service takes over the conduct of the Remount department and the D.G.V.S. becomes the head of the combination. Thus at long last the Army Council has officially recognised that qualified veterinarians, i.e., the officers of the R.A.V.C., are the competent people to deal with the selection, purchase, management and initial training of Army animals. This recognition has not been attained without effort. It is in true conformity with the tradition of the unresponsive, slow moving official mind or temperament that Britain, the pre-eminent live stock nursery of the world, should lag behind other countries in a matter of such great consequence, not only to the Army, but to the nation. In 1900 Wm. Hunting wrote: "To have ridden to hounds seems to have been accepted as proof positive of fitness to buy Army horses." One might add that other qualifications would appear to be that one had time to spare and influence in certain quarters. In times of stress, invitations to assist were also extended to non-professional civilians. The field of selection was wide, the only bar being, apparently, the possession of a veterinary qualification. Selected candidates would vary from bank clerks to horse copers. By various means a heterogeneous body, rivalling "Uncle Tom Cobley and all," would be assembled and given full power to expend the public funds.

Now a man may be what is called "a good horseman over country," he may even have commanded a cavalry unit, yet these qualifications are no

criterion that he is competent to select horses for himself, much less for the Army. It is true that in recent times purchasing boards would have the assistance of a veterinary officer, but that officer was only present in an advisory capacity. The major power was vested in the lay remount official. Why was it necessary to employ two men to do one job? Why is it that it has taken so long to persuade authority that the Army had already in its service officers who, by virtue of their training and years of experience, were competent to act in this matter?

The civilian mind must be more receptive. Commercial firms, owners of large and valuable studs, long ago recognised the value of the veterinarian. Those who entrusted them with the entire management of their studs from purchase to sale did not do this from pure sentiment. They had a positive reward in increased efficiency and decrease in costs.

The Army Veterinary Service has not attained its present high status easily. From its very inception it was bound and fettered by its rivals of the "horsey fraternity." Its free progress was, to say the least, thwarted by those in authority who were inclined to lend an ear to the voice of ignorance and vested interests. It may be that this attitude of mind was directly due to an instinctive fear to change what had been an established practice for so long and a hesitation to adopt new methods. To change methods savours of revolution to the insular mind. It may be that there were some misgivings as to the ability of veterinary surgeons to conduct even minor affairs of state. A veterinary officer was not considered to be of sufficient social standing to hold the same commission as a combatant officer. It was necessary to apply a prefix to his title, so that all might recognise his pseudo inferior status. He was not considered to be capable of functioning alone as a purchaser of horses. He must be supervised, controlled and relegated to his proper place in the Army sphere. The possession of a R.C.V.S. diploma was apparently not an advantage but rather a disadvantage to the recipient, for the knowledge so acquired would oust from his grey matter any administrative ability that he may have possessed previously. It was necessary in the interests of the Service that such poor fellows should be chaperoned and their steps guided. Even those who had attained high rank in the directorate of the Service suffered the indignity of being placed under the control of other departments, such as Remounts or Supply and Transport. Constant attempts were made to emasculate the Service and its rightful progress was suppressed. At the outbreak of the South African War of 1899, the Veterinary Service had been so shorn of its organisation that its state was little better than it had been in Flanders in 1799. The Director of S. & T. at Cape Town was constituted head of the Remount and Veterinary Services, the veterinarians being subservient to Remounts. When these arrangements were made the Director of Veterinary Services was not even consulted. Insult was added to injury by the appoint-

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ment of a combatant officer as Inspector of Veterinary Hospitals in South Africa. What was the result? Mismanagement and incompetence reigned supreme. The waste of animal life was appalling. Remount affairs were chaotic and a first-class scandal was the result. Every remount depot in South Africa was full of horses suffering from glanders and mange. The Veterinary Service was totally inadequate in numbers, many of its members remained civilians and were denied military rank. A civilian with an army is devoid of authority and simply a camp follower and of no consequence to the military caste.

Now the Boer War was really a blessing in disguise for the veterinarian and for the horses. The sufferings of the animals and mismanagement focused public attention on a sorry state of affairs and demands were made for remedies. To their great credit the civilian members of the profession at home did not stand by idly. They were determined that the grievances of the Service should be remedied. The Council of the R.C.V.S. took vigorous action, as did also such great leaders of the profession as J. F. Simpson and William Hunting.

The preliminary skirmishes during and immediately following the war were vigorously and skilfully conducted. They went in favour of the Service and a new Veterinary Warrant was issued in 1902. Those in authority must have held the profession in some contempt, for it is significant that the first intimation of the change was made through the popular Press. The Council of the R.C.V.S. was ignored. Whether this was by purpose or some inadvertence has never been satisfactorily explained. This warrant dealt principally with the terms of service of Veterinary Officers, the major issues were avoided. The Council of the R.C.V.S. were not satisfied and returned to the fray enunciating other points which still required remedy. Amongst these were :—

The appointment of a combatant officer as Inspector of Veterinary Hospitals and the fact that V.O.s were ineligible to purchase remounts. This firm action had the wholesome support of an enlightened public opinion. It led to the appointment of the so-called Hardwicke Committee, which was assembled under the chairmanship of the then Earl of Hardwicke. It was a great triumph.

For the first time, representatives of Veterinary Science were included in a committee assembled to deal with what were mainly veterinary affairs. The veterinarians were Vet.-Col. Thomson, D.G.A.V.D., Prof. Owen Williams, President of the R.C.V.S., and Mr. J. F. Simpson.

A new royal warrant was signed by Edward VII on October 5, 1903. This was the birth certificate of the Army Veterinary Corps. The process of emancipation was initiated.

The opposition was not to be defeated easily. They made use of all the influence at their command to contest the claims of the upstart. The fight was

to be long, but it was a rearguard one of a retreating army, albeit skilfully conducted. The Director of Transport and Remounts put forward his own scheme for veterinary reorganisation. His proposition was to reduce the number of veterinary officers and in their place to substitute young officers of mounted units who would undergo a six months' period of training. Several military veterinary colleges were to be established. Even as late as 1905 some Army authorities were not favourably disposed to the introduction of veterinary hospitals. One writer in the *Cavalry Journal*, Vol. II, 1907, said: "They aimed a direct and deliberate blow at horsemastership among combatant officers and farriers." One cavalry commander protested against the presence of a hospital in his barracks, as it did not come under his control.

Every possible argument and difficulty, real and imaginary, was put forth, but the march of progress could not be stayed. Such was the see-saw of Service politics; suppression, opposition, contempt—all failed. The veterinary officers went on loyally doing their job, and doing it well. Recognition and status was won for their service in no small measure by their exemplary conduct. The ten years between 1903-1913 marked the adolescence of the A.V.C. It was not easy, there were many rebuffs, but the pendulum was swinging in the right direction. Of the trials and troubles of these times we may well pass to the memorable Army Order 402 of the year 1913. This granted a Veterinary Directorate independent of the Remount Department. The Veterinary Service was free to function and responsible only to the Quartermaster-General of the Army. This was the emancipation, and the outbreak of the Great War of 1914-1918 found a service which was efficient and prepared to serve the country in its hour of need. What a great test awaited! How great was the response. Never have veterinarians had such opportunities and given greater service to the State. The Corps increased in numbers and in the variety of its tasks. It had representatives in every quarter of the globe, 1,668 officers and 41,755 other ranks were joined in its service. There was to be overwhelming proof of its efficiency and of its ability to manage its own affairs and of its service to the State. On November 27, 1918, the Army Veterinary Corps was granted the title and status of a "Royal" Corps. The Quartermaster-General of the Forces, in congratulating the Director-General and all ranks of the Army Veterinary Service, said:—

"On the occasion of His Majesty the King being graciously pleased to raise the Army Veterinary Corps to the status of a 'Royal' Corps, the Quartermaster-General to the Forces wishes to convey to all ranks his congratulations and appreciation of the good work which they have performed during the present war.

"The Corps by its initiative and scientific methods has placed Military Veterinary Organisation on a higher plane. The high standard which it has maintained at home and throughout all theatres has resulted in a reduction of

animal wastage, an increased mobility of mounted units and a mitigation of animal suffering unapproached in any previous military operations."

What a great testimonial to a young service! In spite of this evidence of its worth the Royal Army Veterinary Corps was evidently not considered to be capable of managing the affairs of Remounts. That superfluous department continued its existence until January, 1940. It has taken over forty years to convert the official mind to a truth which has been manifest to generations of reasonably intelligent individuals. There is nothing extraordinary or mysterious about Remounts. Even if such was the case it would be reasonable to suppose that these affairs would be best administered by the Department whose officers are by virtue of their professional training and experience the most competent to act. That such has been at long last officially recognised must be of great satisfaction to our Service and to the benefit of the State.

The change, so hardly won, offers great and further opportunities to the Veterinary Service to prove its worth. Of its success there can be no doubt. The serving officers of to-day owe a great debt to those who preceded them, for by their loyal service they paved the way to present recognition. It is unnecessary to remind all interested that the fight for recognition, conducted over so many years, was not waged with the selfish motive of any benefit which might accrue to the Army Veterinary Service but in the true interests of the animals concerned, of the Army as a whole, and, above all, for the benefit of the State.

The Royal Army Veterinary Corps has not as yet attained its full maturity in the service of the State. The time will come when full use of its services will be utilised in safeguarding the food of the Army such as is recognised as being essential in civilian affairs.

Abstracts of Current Literature

"Falling Disease" of Cattle in the South-West of Western Australia. 2. Studies of Copper Deficiency in Cattle. By H. W. BENNETTS, A. B. BECK, R. HARLEY and S. T. EVANS. *Aust. Vet. J.* 1941. *XVII*, 85.

BENNETTS AND HALL have already described "falling disease" (*Aust. Vet. J.* 1939. *XV*, 152)—a disease "characterised by a seasonal occurrence and by sudden death almost invariably without premonitory signs." Glomerulo-nephritis and marked hæmosiderosis are regarded as pathognomonic. The disease was shown to be associated with the occurrence of a severe anæmia in

affected herds during the season of incidence. A low copper status of animals and pastures was also demonstrated.

The present paper deals with copper deficiency in cattle—the data being obtained from experimental and commercial herds.

The authors summarise their observations as follows :—

1. A very low copper status of pastures and of animals is constantly associated with the occurrence of " falling " disease. The ætiology of the disease remains obscure, but the investigation of the role played by copper has led to the accumulation of experimental and other data relative to what appears to be an uncomplicated copper deficiency disease of cattle in the south-west of this State.

2. Clinically the manifestations of copper deficiency are malnutrition, anæmia, a depraved appetite, and in cows frequently as temporary sterility. Young animals show marked evidences of malnutrition and abnormal development; intermittent diarrhœa and anæmia are frequently present.

3. The pathology of this disease has been studied only incompletely. The most marked features are anæmia and hæmosiderosis, the anæmia in cows being of the macrocytic hypochromic type.

4. In an experimental dairy herd optimal response was obtained by the administration of pure copper supplements; the addition of other minerals had no appreciably beneficial effect.

5. Under field conditions the widespread use of mineral supplements containing copper has resulted in a marked improvement in health and production of the entire herds, and apparently in the prevention of any occurrence of " falling disease " in cows receiving such supplements.

Proteins - Minerals - Vitamins: Some Observations Concerning Requirements of Animals. By E. W. CRAMPTON. *Canad. J. Comp. Med.* 1941. *5*, 183.

PROTEINS, minerals and vitamins must always be of considerable interest to veterinary surgeons who have to deal with the feeding of livestock and with ailments which might be associated especially with deficiencies of such substances. This article deals with the subject in such a manner that we recommend its perusal to all interested. The article is reproduced in full.

" With our increasing knowledge of biology it is inevitable that many branches of this subject which are obviously related shall be found to overlap the original boundaries which, in our incomplete information, we have somewhat arbitrarily set up to separate them. Nowhere is this more strikingly evident than in the case of nutrition and health, be it human or animal. Indeed, it now appears that there can be no sharp division between these two fields, though of course in many respects they do not at all overlap. But there can be no question that many conditions of ill health are the result of

inadequate nutrition and yield only to diet therapy. In this sense, diet may also be logically considered as a part of 'preventive medicine.'

"Obviously both the feed manufacturer and the veterinarian are interested in this intermediate field, together with a third group, the nutritionists who are expected to provide through their research, the facts concerning the fundamental dietary needs of the animals in question. And it is presumably because of my connection with this third group that I have been invited to summarise for you the present status of those requirements of farm stock which when not adequately met lead to inefficient production if not indeed to so-called deficiency diseases. These nutrients most often involved are proteins, minerals and vitamins, and I shall confine myself to these three groups.

"In the interests of time I shall not attempt to describe in any detail clinical symptoms nor to elaborate specific dietary formulæ. Also evidence supporting the statements to be made may be conspicuous by its absence, though I shall avoid statements for which satisfactory experimental evidence does not exist. Even with these restrictions it will be possible to consider only the more often met with problems of providing animals with nutritionally adequate diets.

"PROTEIN.

"It is common knowledge that the animal body requires for adequate nutrition a certain minimum of protein—or more correctly of an assortment of its component amino acids. However there have arisen many erroneous beliefs concerning protein quality and the quantity desirable in specific livestock feeds.

"First as to amounts of protein. Experiments strongly suggest that the *complete diet* for young animals need not contain, on an air-dry basis, over 15 to 17 per cent. of protein (calculated as N x 6.25) regardless of class of stock, and for mature animals this is probably excessive. Feeding standards for adults, both human and animal, call for only about 10 per cent. of the total calories to consist of protein. At a level of 15 per cent. protein the ration of young animals apparently shows its greatest efficiency as measured by gain per unit of feed eaten. Muscular work does not increase the proportion of protein to energy nutrients needed. Nor does increasing milk production call for any change in the percentage of protein of the air-dry ration, for the energy demand in either case increases as fast as does that for protein.

"The protein content of any part of the ration, as the grain allowance, will then be influenced by the per cent. protein of other feeds also used. For example, half or more of the dry matter of the dairy cow ration is supplied by roughage. Legume roughage, cut on the immature side, may analyse 15 to 18 per cent. protein while timothy hay, cut late, frequently carries but 3 per cent. protein. Obviously the protein content of the meal to be used with the

latter roughage must be greater than is needed when the high grade legume roughage is fed.

" The belief is sometimes held that high protein intakes are harmful. The fears, however, are groundless. At least neither diet surveys nor direct experimental evidence support this belief. There are a few particular proteins, as those of egg white, which if fed alone and in excess, may be toxic. But there is no evidence that the protein complex as such of animal foodstuffs is harmful. On the other hand increasing the protein of a ration already adequately supplied will not stimulate extra milk production.

" The species of animal does make a difference with regard to kind of protein. There is no doubt that omnivora and carnivora require certain preformed amino acids in the diet. The exact list of so-called essential amino acids is unknown excepting possibly for the rat. It is not the same either qualitatively or quantitatively for maintenance as for growth and there may be other factors affecting the requirement. Rate of synthesis of certain acids as well as inability of synthesis is most certainly involved. Hence rate of growth of the animal becomes one such factor. Careful distinction must also be made between growth of ' protein ' tissue and live weight increase, largely fat—as in more mature fattening animals.

" So far, the chemist is not able to give the exact amino acid make-up of the proteins of foodstuffs any more than the nutritionist can specify the requirements. However, experiments indicate that for pigs if one-quarter of the protein of the ration is derived from animal sources, such as fish meal or meat meal, and the balance from standard vegetable sources as oil meal, that the quality of protein need cause no further concern. Variety of protein from plant sources without inclusion of some animal protein cannot be relied on to provide a protein complex of satisfactory biological value. Incidentally, it may be pointed out that meat meal is preferable to digester tankage as an animal feedstuff. Furthermore, no digester tankage is made in Canada, and when called for is prepared by adding blood meal to meat meal to boost the protein to the desired level. The proteins of blood meal appear to be of low biological value—hence the choice of meat meal which is free of blood.

" With ruminants, and perhaps all herbivores, quality of ration protein is of less concern. Through the mediation of the normal bacterial flora of the rumen the amino acid complex of the diet as consumed is considerably modified. It appears that these micro-organisms can and do utilise even simple nitrogen compounds, such as ammonium carbonate and urea, and that the tissue proteins which they synthesize contain ' essential ' amino acids needed and subsequently utilised by the cow. The addition of urea to provide up to one-third the nitrogen of the ration is permissible under the Feeding Stuffs Act in the United States. The feeder therefore cannot expect the same improvement in the nutrition of his dairy stock through complicated protein ' concentrates '

that often follows their use in hog rations. Indeed, it is probable that quality in protein can be largely forgotten in the case of ruminants.

"MINERALS.

"The mineral requirements of livestock are, quantitatively, less well understood than those for organic energy-yielding nutrients. It may be well at the outset to summarise what are usually accepted as facts concerning their requirements.

"1. Some 13 mineral elements are known to be essential components of animal rations. These are: Calcium, phosphorus, sodium, chlorine, iron, iodine, copper, cobalt, magnesium, manganese, potassium, sulphur, and zinc. There may be others, but the absence of any of the above list causes changes in normal metabolism which are detectable with present methods of study.

"2. Of these elements it is seldom if ever necessary to specially fortify practical rations made up of natural foods with any but the first six; and for most mature stock, only calcium, phosphorus, and common salt (sodium chloride) are needed in excess of the minerals of the usual ration.

"3. There are geographical areas, not yet completely defined, within which there are specific mineral deficiencies in the natural foods. Thus in Canada iodine must be especially fed in so-called 'goitre regions.'

"4. Certain classes of animals may require the supplementary feeding of iron. In general this need is confined to pregnant sows, and to young pigs during the time their diets are largely of milk. Many mineral mixtures containing iron also contain copper, since the latter is necessary for the utilisation of iron. Omission of the copper is not likely to be serious, however, for most stock rations actually contain enough copper to enable the use of the iron.

"5. There is as yet no established experimental evidence that the special inclusion of such minerals as sulphur, potassium, magnesium, manganese are necessary in the practical rations of the larger farm animals. The fact that the herds at recognised experiment stations are successfully raised on rations without additions of these elements and that recommendations for their use are not found in the literature from these stations is strong evidence against the need of their inclusion in usual livestock rations. Manganese may be needed in poultry rations.

"6. No class of stock can be depended on to choose needed minerals nor to consume proper amounts of any mineral (other perhaps than common salt) when they are merely placed before them.

"7. All classes of stock are subject to mineral deficiency diseases (such as rickets, anæmia, goitre) if their diets are deficient in the necessary mineral elements.

"These statements immediately raise certain questions in the practical feeding of livestock. Perhaps the first is: Why are so many materials often

included in commercial mineral mixtures? Perhaps it is partly on the argument that if a little is good, more must be better. Fortunately for the vendor and unfortunately for the feeder these unnecessary ingredients of mineral mixtures are usually harmless—fortunate for the salesman because no ill effects are likely to follow their use; unfortunate for the feeder because he has no defence against the argument that they can do no harm and may do some good.

"Nutritionally the argument against the complex mineral mixture is that by the inclusion of non-essentials, more than normal amounts of the total mixture must be fed to provide the needed amounts of essential minerals. Furthermore, if some ingredient such as salt appears in too large proportion to calcium, for example, either the salt will be fed in excess or the calcium in too meagre amounts to provide against calcium deficiency. The problem of balance in the mineral combination is somewhat different than in the case of organic nutrients since the former are specific and not interchangeable as to function. Extra protein, for example, is usable as energy in lieu of carbohydrate. Excess calcium, however, will not replace phosphorus and indeed may interfere with the utilisation of the phosphorus present.

"At this point a species difference in the calcium and phosphorus requirement may be noted. Because of the difference in amount and kind of feed other than meal, phoshorus is more apt than calcium to be deficient in the dairy ration. Hence the inclusion of limestone in the dairy mineral mixture is usually to be questioned. In the mineral supplement for pigs tests indicate the exact reverse; i.e., that calcium deficiency is the larger.

"It may be well to elaborate briefly on the question of iodine. The striking effects of idoine administration in cases of obvious deficiency have not only over-shadowed the results of iodine feeding to animals showing no gross deficiency symptoms, but have led to the general acceptance of the appearance of these symptoms as the sole criteria of a need for supplemental dietary iodine. The published literature, however, contains ample evidence for the belief that the *optimum iodine intake* is above that merely sufficient to prevent the appearance of goitre and/or the accompanying pathological conditions. In general it may be stated that rates of growth and production, and normal reproduction are intimately associated with adequate iodine intake, and that in many districts not now included in so-called 'goitre areas' the inclusion of iodine in the rations of stock is to be recommended.

"On the other hand iodine is in no sense a cure-all for reproductive failure. It is a dietary essential. If the usual diet does not provide it in sufficient amounts, then supplements must be resorted to. Above the optimum further intakes are not nutritionally necessary nor advantageous.

"This brings up the question of the sources of the essential mineral elements. It appears established that mineral supplements are valuable in proportion to their content of needed minerals. Thus the mono-, di-, tri-

calcium phosphates, for practical feeding, differ only in the proportions of calcium to phosphorus. Or for the prevention or cure of nutritional anæmia (as measured by hæmoglobin level of blood) reduced iron, ferrous sulphate, ferric oxide, and ferric ammonium citrate differ only because of differences in iron supplied. Indeed reduced iron may be 20 per cent. ferric oxide. After all it is the Fe ion which is utilised and not the salt or organic complex in which it is ingested. Iodine likewise may be supplied in any one of several forms which apparently are useful in proportion to the iodine they contain.

"In the last analysis it seems that there are two chief factors in determining the choice of a mineral supplement—presence of toxic or undesirable substances, and cost. As to toxicity, it is generally unsafe to depend on rock phosphate because of its probable fluorine content. Sodium iodide may be less toxic in excessive doses than the potassium salt—it is believed by some that the toxicity is related to the potassium rather than to the iodine. Actually the fear of iodine poisoning has been greatly over-emphasised. Use of a stabilised iodine is of much more significance than the problem of overdosage.

"In the matter of cost, it must be obvious that food substances purchased at some retail drug store are likely to carry drug rather than food prices.

"The exact quantitative requirements of the several species of farm animals for the minerals which are likely justifiably to be especially included in their rations are unknown in most cases. There is some information, however, on the level of intake which appears to be at least adequate for average conditions.

"*Salt.*—Excepting poultry, one half of one per cent. of the air-dry feed for all stock. When the ration is half roughage (by weight) as with cows, horses and sheep, the percentage of salt to be added to the meal will be double the above figure. Thus the usual rule: 1 per cent. salt in meal for cattle, sheep, and horses; and 0.5 per cent. for pigs.

"Poultry require about 1 per cent. salt in the daily feed.

"*Ca and P.*—About equal amounts of these minerals are needed, but the ratio may be distorted rather widely providing adequate vitamin D is present. Herbivora should receive daily an allowance each of Ca and P equivalent to not less than 0.25 per cent. of their daily feed (air-dry basis), with double this for hogs. Poultry should receive much greater allowances than any of the larger animals: 0.8 per cent. of Ca and 0.5 per cent. of P for young stock and 2.5 per cent. of Ca and 1.0 per cent. of P for layers.

"The quantities of Ca and P to be provided *by special supplement* will of course depend on the ration consumed. In general, herbivora may need extra P but not Ca because of the Ca content of the roughages eaten. With average feeding, inclusion of 2 per cent. bone meal in the meal mixture for cattle and

sheep and 1 per cent. bone meal plus 1 per cent. ground limestone for pigs will be adequate protection against deficiency.

"*Iodine.*—Where iodine is needed the following daily allowances for breeding females represent average recommendations: horses and cattle, 100 mgm.; sheep and swine, 65 mgm.; poultry, 10 mgm.

"*Iron.*—Probably needed as a supplement only by nursing pigs and by pregnant sows. Administered to suckling pigs at rate of 15 mgm. Fe daily, experiments indicate that normal Hb is maintained. Weekly or even bi-monthly doses appear to be satisfactory.

"*Manganese.*—For poultry there may be justification for the addition to the ration of manganese. A rate of .012 per cent. (4 oz. per ton feed) has been recommended. Manganese sulphate has been used.

"These detailed recommendations may, for practical feeding purposes, be combined into mineral mixtures of which the following are examples:—

"TYPICAL MINERAL MIXTURES.

Ingredients	*Hogs (2-3 per cent. of meal)*	*Cattle, Sheep, Horses (3-4 per cent. of meal)*	*Poultry (3-4 per cent. of meal)*
Salt	25 lbs.	35 lbs.	30 lbs.
Bone meal	50 lbs.	65 lbs.	10 lbs.
Limestone (or $CaCO_3$)	23 lbs.	—	60 lbs.
Ferric Oxide ...	2 lbs.	—	—
Potassium iodide ...	2 oz.	3 oz.	—
Manganese sulphate ...	—	—	6 oz.

"VITAMINS.

"The importance of adequate vitamin intake is recognised by all nutrition workers. However the recommendations concerning the use of vitamins for diet fortification have often been based on little or no direct experiment evidence—at least as to quantity. The question is complicated by species differences—perhaps not in fundamental requirement, but in dietary requirement because of differing facilities for synthesis.

"One of the difficulties in establishing optimum intake of vitamins has been failure to recognise criteria of suboptimum levels. These may be considerably involved with other deficiencies. For example, it has been rather generally believed that cattle fed good quality roughage and yellow corn were adequately provided with vitamin A via its precursor, carotene. Such animals appear to be in good health. Milk flow continues normal. However their reproduction may be below par, and the calves may suffer from scours. Now vitamin C is known to be synthesised by all animals. It is not so generally known that the extent of vitamin C synthesis by the bovine is in some way dependent on the state of vitamin A nutrition. And too meagre synthesis of

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vitamin C spells reproductive failure. Ascorbic acid cannot be given by mouth to cattle since it is destroyed in the rumen, but subcutaneous injections have resulted in return of fertility in about 75 per cent. of cows and bulls whose reproductive organs are normal. Thus a shortage of vitamin A may indirectly cause breeding failure through its relation to vitamin C synthesis.

"As to calf scours, the vitamin A intake of the pregnant cow is again to be suspected. Strange as it may seem the new-born calf is without stores of vitamin A. It must depend on colostrum for its initial supply. Unless this is forthcoming, the integrity of the lining of digestive system and respiration tract cannot be maintained. Thus, deficient intake of vitamin A by the calf leads to scours. But the concentration of vitamin A in colostrum depends on the diet of the cow—especially of the dry cow, whose ration is all too often given little consideration in this respect.

"Deficiency of vitamin B, or of some parts of it, is also often related to calf scours; and here again the potency of its mother's milk depends on the vitamin level of the cow's ration. Stubborn cases of calf scours have yielded promptly to daily oral administration of some 15,000 I.U. of vitamin A plus small amounts of a mixture of thiamin, riboflavin, choline, pantothenic acid and nicotinic acid. Yeast would do nicely for this B complex (10 to 15 gms. per day).

"What has been said about the importance of adequate vitamin A in the rations of the pregnant cow applies equally well to pregnant sows. Scours of very young pigs are an indication of faulty pregnant sow diet. The colostrum from sows whose rations are properly fortified with vitamin A will carry about 1,000 I.U. per 100 c.c. while that from sows on deficient rations may run as low as 30 I.U.

"One problem facing the dairy cow feeder is: where supplementary vitamin A may be obtained for winter rations. Cod liver oil cannot be advocated because of its depressing effect on butter fat yield. Recent evidence indicates that shark oil does not have this effect and may be used without fear of harmful results. Another source is grass silage provided of course the crop ensiled was in a leafy stage of maturity. Data at Macdonald College indicate that such silage from clover cut in early bloom and preserved with molasses may be expected to carry about 100 gamma of carotene per gram of silage or 45,400 I.U. per lb. It has been shown that a daily intake of 300,000 I.U. carotene by the dairy cow is needed to maintain the vitamin A level of her milk at maximum. Thus 7 lb. of grass silage would meet her total daily needs. The minimum daily intake of carotene required by cows for normal lactation and reproduction is 40 to 45 I.U. per lb. body weight to prevent night blindness given by Califoria for all species (1 I.U. vitamin A = 1 gamma carotene).

"Fresh pasture green grass is a very rich source of carotene (160 to 200

gamma per 100 grms. of herbage) and the storage facilities in the liver of the cow are such as to prevent serious decline in quality of milk until three or four months after the winter feeding begins. After the new year, however, many dairy cow rations need fortification with some source of vitamin A for an adequate diet.

" The position of vitamin E remains uncertain. Most research workers feel that, except for the rat, sufficient evidence does not yet exist on which to finally conclude that this vitamin, alpha tocopherol, is required for reproduction. The value of wheat germ or of wheat germ oil, where this has been demonstrated, may of course lie in some other substance than its vitamin E. For example, wheat germ is one of the richest sources of B_6 (pyridoxine), a vitamin recently shown to be needed for the synthesis of fat from protein. Admittedly there is but meagre information on vitamin E question. One must bear in mind that for many species natural sources of this or any other vitamin are incompletely known. The more 'artificial' the ration the greater the probability that its special fortification will be required—particularly with those enzymes and vitamins whose presence in many foodstuffs is as yet not quantitatively established. For example, with fur-bearing animals less is known concerning requirements than with species longer domesticated.

" This can be said concerning vitamin E: it is probably the most widely distributed in natural foods of any of the vitamins, and rations composed largely of such foods are not likely to be deficient in this substance.

" Vitamin D, on the other hand, is, in this latitude, one which must be considered by the feeder of pigs, calves, and poultry. An unusual fact must also be recognised; namely, that the forms of vitamin D in cod oils (D_1), that produced by the irradiation of the sterols of plant material (D_2, calciferol), and that by irradiation of animal oils (D_3, 7-dehydrocholesterol), have different antirachitic potencies for poultry as compared to animals. D_1 and D_3 are of similar potency unit for unit, for either animal or fowl; while D_2 is much less effective for the latter stock.

" Vitamin D is not a naturally occurring vegetable product but must come either from an animal source or from the irradiation of sterols in dead plant tissue. Thus we have a peculiar situation with regard to hay. Well saved, leafy hay is a rich source of carotene, precursor of vitamin A. On exposure to the sun during curing, however, much vitamin A potency is lost (75 per cent. in 12 hours' exposure in the window). But coincidental with this loss, it takes on antirachitic potency through conversion, by irradiation, of its ergosterol to calciferol or D_2.

" Vitamin D has the most limited distribution of all vitamins in nature. Contrary to popular belief, neither animal tissues, the seeds, stems, or leaves of plants, nor vegetables, are sources of any vitamins of the group. Nor is milk a rich source.

" Incidentally, vitamin D_3 is the most important naturally occurring form

and is the one found in tuna and halibut oils. It is also the form produced by exposure of animals to sunlight. The skin, wool, and feathers of animals or poultry contain a sterol (7-dehydroxycholesterol) which on exposure to ultra-violet rays is converted to this form of vitamin D.

"Minimum requirements of animals and fowl, and hence the minimum supplemental levels of vitamin D for feeding, are not known with certainty. It is questionable whether adults need special D supplements other than pregnant individuals, where the extra requirement is for normal Ca and P metabolism of the fœtus. The human infant is estimated to need 300 to 800 U.S.P. units daily. One teaspoonful of medicinal C.L.O. will contain not less than 300 units. For normal growth and bone calcification, calves need 300 U.S.P. per day per 100 lb. body weight. In general, C.L.O. carrying 100 I.U. per grm. of D, if incorporated in the ration to the extent of 1 per cent. of the dry weight, will provide adequate protection against rickets for hogs and poultry.

"Of the other vitamins little can be said at present in so far as their relation to the larger animals is concerned. Normally the feeder need not worry about vitamin C. And for mature ruminants the whole B complex is apparently synthesised in the rumen. For calves before rumen development is complete it is probable that the members of the vitamin group must be provided. There is evidence that thiamin, panthothenic acid, and nicotinic acid along with vitamin A may be needed in supplementary form in cases of calf scours. The same apparently applies also to nursing pigs that show scours—and perhaps also a tendency to drink urine.

"CONCLUSION.

"In conclusion, it may be in order to caution against the assumption that all the problems of the livestock feeder can be traced to faulty diet. Many of them can; and without a nutritionally adequate diet other remedies are of little avail in maintaining animals at efficient levels of production. On the other hand, neither proteins, nor minerals nor vitamins are anything but dietary 'operating needs.' They are not stimulants nor medicines and cannot be considered nor used as such with hope of success."

Tuberculosis of the Genital Organs of Cattle and Intrauterine Infection of the Bovine Fetus. By K. A. HERMANSSON, Norrköping, Sweden. Abstracted, with Comments, by W. L. WILLIAMS, Ithaca, N.Y. Reprinted from *North Amer. Vet.* 1941. *22*, 347.

HERMANSSON* studied, after slaughter, 42 tuberculous cows having tuber-

*The original contribution, "Tuberculose der Geschlechtsorgane beim Rind und intrauterine tuberculoese Infektion beim Rinderfoetus," by Dr. med. vet. K. A. Hermansson, appeared in *Meddeland nr 21 fran Saellskapet foer veterinarmedicinsk Forskning*, 1940; was translated into German by Dr. Eugen Bass and appeared in the *Deutsche Schlachtof-Zeitung* (*German Slaughterhouse Times*) of December 10 and 25, 1940, from which this abstract was made.

culous lesions of the genital organs, 40 of which were pregnant when slaughtered, and two had recently aborted. The 42 fetuses were obtained for study. More or less tuberculous pus was recognised in the uterochorionic space in 41 cases (98 per cent.). The tuberculosis of the cows was usually generalised (lungs, liver, lymph glands, mammary glands). There were necrotic areas within the uterus in 55 per cent. of the cases, and tuberculous lesions of the caruncles were recognised.

Of the 42 fetuses, 33 (78.5 per cent.) showed definite tuberculous lesions, in nine of which the lesions were not macroscopic. In all 33 cases showing tuberculous lesions, the lymphatic glands of the liver were involved. This was not true of other organs and Hermansson felt that the uniformity of the lesions in the liver was of great significance in showing the path of invasion.

No tuberculous lesions were recognised in nine of the 42 fetuses. Three of these were one to two months old and did not offer favourable opportunity for study. In two fetuses without macroscopic lesions, tuberculous infection was recognised by the inoculation of guinea pigs. Hermansson thought that it was not improbable that some of the other fetuses, which failed to reveal macroscopic lesions, were infected.

The ages of the fetuses showing macroscopic lesions were: nine months in eight cases; eight months in nine; seven months in seven; six months in eight, and five months in one case. Tuberculous lesions were observed in no fetus at less than five months. Hermansson concludes that when genital tuberculosis is extremely severe, and conception occurs, the embryo dies early and disappears unseen. If the genital infection is milder, the fetus may be aborted in later pregnancy, as in two of his cases, or the calf may be born with congenital—not with inherited—tuberculosis.

The series of 42 cases studied by Hermansson all showed advanced tuberculosis of other organs in addition to the genital lesions. He concludes that there is no evidence that any one of the cows contracted tuberculosis through copulation with a diseased bull. [In "Diseases of the Genital Organs of Domestic Animals," I have presented what I believed to be conclusive evidence of the transmission of tuberculosis to the bull through coitus with a cow suffering from genital tuberculosis: that is a greater probability.—*W.L.W.*] If the infection were coital, cases should be found in which the lesions are confined to, or at least concentrated in, the genital system, but this rarely occurs in the female.

While Hermansson believes that the spread of tuberculosis through the animal body is usually through the blood or lymph stream, the fact that genital tuberculosis in the cow is usually associated with extensive peritoneal lesions suggests that the infection may enter through the oviduct, like an ovum, which is supported by the observation that this duct is prominently

involved. In such cases it appears probable that the invasion occurs during estrum and the tubercle bacilli accompany the ovum. This may result in sterility or conception followed by infection of the fetus, which may lead later to abortion or to the birth of a tuberculous calf. In the latter case the infection of the fetus occurs late in gestation and primarily involves, with marked constancy, the lymph glands of the liver.

There is almost constantly present in the uterochorionic cavity, in varying volumes, masses of odourless, tough, sticky pus, in which abundant tubercle bacilli were present. The purulent masses were largely about the necks of the caruncles. [The pus masses, in texture, location and other respects, as described by Hermansson, were essentially identical, macroscopically, with the so-called "exudate of contagious abortion," announced immediately following Bang's notable discovery. It now appears that the macroscopic character is not controlled by the infection but by the structures—endometrium and chorion—involved and that the cause of the exudate is to be determined by bacterial study. Apparently an unknown number of bacteria may cause such exudate. —*W.L.W.*] Tuberculous lesions were usually present in the cotyledons of the caruncles, as well as in the intracaruncular endometrium.

Hermansson found tubercle bacilli only exceptionally in the fetal stomachs, under conditions which seemed to indicate that primarily the infection invaded the liver and thence became distributed among other organs.

Brucellosis in Horses and Goats in New York State.* By W. S. Stone. *Rpt. N.Y. State Vet. Coll.* 1939-40. 192.

This article runs to 35 pages. An excellent summary of the literature is given with a full list of references to literature on the subject. It will be recalled that the association of *Br. abortus* with poll evil and fistulous withers was described in this country by Duff (*Vet. Rec.* 1936, *16,* 175, and *J. Comp. Path. & Therap.* 1937, *50,* 151) and that several papers have appeared concerning agglutination titres in the horse. In this paper horses under different conditions, e.g., in the country, in town stables, etc., were used in the survey as well as horses in veterinary clinics. This contribution adds to our knowledge of the subject. The author's summary is as follows:—

"A total of 1,741 New York State horses were tested for Brucella infection. Three groups; namely, city, country, and clinic horses, comprised this total. More reactions to the agglutination test were found in clinic horses than in either of the other two groups. New York City had the smallest percentage of reacting horses, and the number of reactors in country horses fell between the two extremes. Approximately 65 per cent. of the city horses,

* Thesis submitted to the faculty of the Graduate School of Cornell University in partial fulfilment of the requirements for the degree of Doctor of Philosophy, June, 1940.

53 per cent. of the country horses, and 44 per cent. of the clinic horses are completely negative to the agglutination test for Brucella. Titers in the reacting horses ranged up to a complete reaction at 1 : 51,200.

" None of the New York City horses suffered from fistulous withers or poll evil and no attempt was made to isolate Brucella. *Brucella abortus* was isolated from a few country horses that had fistulous withers. Many of the clinic horses were affected with fistulous withers or poll evil and *Brucella abortus* was isolated from 80 per cent. of the cases that arrived in the clinic with unruptured lesions. In no case was *Brucella abortus* isolated when the animal arrived in the clinic with the lesion ruptured. Not all of the horses with fistulous withers and poll evil had Brucella agglutinins in their blood sera. Of 112 cases 20 per cent. were negative in all dilutions.

" A negative prozone occurs frequently in equine serum when the standard tube agglutination test is used. The negative zone usually appears in the low dilutions of 1 : 25 and 1 : 50 but may extend through a dilution of 1 : 1,600.

" Horses were infected with *Brucella abortus* by intradermal and subcutaneous injections of live cultures. Abscesses formed by subcutaneous inoculation soon became contaminated with other organisms and *Brucella abortus* was not isolated for more than three days after the abscess opened.

" *Brucella abortus* was not isolated in the fresh fæces of either negative or high reacting horses. In two cases of severe gonitis, *Brucella abortus* was obtained in pure culture.

" Several goat dairies were examined and 419 goats were tested for Brucella infection. Only 23 of all those tested had any Brucella agglutinins. No goat was found with a titer as high as 1 : 100. Brucella organisms were not isolated either in the milk or body tissues of any New York State goats."

Effect of Novoxil Liquid on Catarrhal (Chronic) Mastitis and on Streptococcus Agalactiæ Udder Infection. By L. A. KLEIN, A. L. KLECKNER and R. O. BILTZ. *Amer. J. Vet. Res.* 1941. *II*, 145.

NOVOXIL liquid is described as a colloidal dispersion of silver oxide in a light mineral oil. This article describes the effect of this material, when injected into the milk cistern, on catarrhal mastitis, on *Streptococcus agalactiæ* and on the udder tissues and milk secretion. The main results are contained in the summary and conclusions, which are as follows :—

" Twenty-three cows with 67 quarters infected with *Streptococcus agalactiæ* received injections of novoxil liquid in the infected quarters. Ten of the cows showed clinical symptoms of catarrhal (chronic) mastitis in 19 of the infected quarters. Novoxil liquid is a colloidal dispersion of silver oxide in a light mineral oil.

"Novoxil liquid containing 2.5, 3, 5 and 10 per cent. silver oxide was injected into different udder quarters. Five to 20 c.c. of the same concentration was injected one to ten times at intervals of 12, 24, 48 and 72 hours. All but eight of the cows received a single course of treatment while in milk. Five were given repeated courses of treatment while in milk and three received a single injection during the "dry" period.

"The *S. agalactiæ* infection was destroyed in 59, or 88.1 per cent. of the infected quarters. The infection was destroyed in all infected quarters in 19, or 82.7 per cent. of the cows treated, thus freeing them of the infection entirely.

"Ten, or 52.6 per cent. of the quarters showing clinical symptoms of catarrhal mastitis recovered from the symptoms and the infection was destroyed. The clinical symptoms of mastitis and also the infection disappeared from all of the quarters in five, or 50 per cent. of the cows showing clinical symptoms of catarrhal (chronic) mastitis before treatment.

"The results were satisfactory in the few cows treated with the 2.5 and 3 per cent. concentration, but the reaction of the udder was not much greater with the 5 per cent. concentration and the latter was used in most cases as it was assumed that it would be more certain in its effects.

"Injections at 24-hour intervals appear to be more effective than at 72-hour intervals but only approximately one-third of the cows treated received injections at 24-hour intervals. Three to five injections were more effective than a lesser number. These statements should not be regarded as conclusive, however, because of the limited number of cows involved.

"Swelling of the udder and a change in the appearance of the secretion occurred in all cases following the injections, but these changes were only temporary.

"The greater quantity of the silver injected into a quarter was eliminated in about five days following the last injection, but traces were present in the milk for some weeks later."

A Study of the Factors Governing the Passage of Fluids through the Stomach of Sheep. By P. N. NANDA and GURBAX SINGH. *Ind. Jl. Vet. Sc. & An. Hus.* 1941. *XI*, 16.

AFTER a full description of the experiments and observations, the authors record the following summary and conclusions:—

"From the experimental data recorded during the year 1939-40 it has been found that:—

"1. Copper sulphate in solution is able to stimulate the reflex closure of the œsophageal groove.

"2. The intensity of the stimulation of the reflex with copper sulphate

solution is more marked with a stronger solution when administered under identical conditions of preliminary starvation.

"3. Preliminary starvation is a favourable condition for the stimulation of the reflex, and the ability of copper sulphate solution to stimulate the reflex may be greatly retarded even with a 2 per cent. solution, when the animal is not starved.

"4. Water, probably, possesses a slight inherent property to pass into the abomasum which increases with the period of preliminary starvation to such an extent that 4 ounces of it when given after withholding food and water for 38-42 hours will pass as a whole or in bulk into the abomasum.

"5. The stimulation of the reflex is not influenced by the mode of administration of fluids.

"6. There is some indication that the equilibrium of food and water in the rumen is also a controlling factor in influencing the passage of watery fluids to the various divisions of the stomach of sheep.

"7. There is no necessity to fast sheep after routine dosing for gastro-intestinal worms but access to water should be allowed to a limited extent, after allowing free grazing for some time."

The Swine Lungworm as a Reservoir and Intermediate Host for Swine Influenza Virus. I.—The Presence of Swine Influenza Virus in Healthy and Susceptible Pigs. II.—The Transmission of Swine Influenza Virus by the Swine Lungworm. By RICHARD E. SHOPE. *J. Exp. Med.* 1941. *74*, 41 and 49.

IN the August number of THE VETERINARY JOURNAL we presented an abstract of a paper on swine influenza described in this country. Reference was also made to some of the findings of American workers, including Shope.

This author has continued his observations on the disease. He found that while using *H. influenzæ suis* vaccines in connection with the prophylaxis of swine influenza an illness was set up in the injected pigs. With the vaccines composed of the living organisms the disease was acute and clinically was indistinguishable from swine influenza. With vaccine prepared from heat-killed cultures, a mild disease only was produced. He found on further examination of the lungs of the injected pigs that swine influenza virus was present (shown by mouse inoculation) and recovered pigs, when tested for immunity to swine influenza, were found to be fully immune. He states that: "The disease observed in the animals injected with living *H. influenzæ suis* was true swine influenza in that both the virus and the bacterial component were active; while the disease developing in the animals inoculated with heat-killed *H. influenzæ suis* was 'filtrate disease,' such as is caused by experimental infection with the swine influenza virus alone, and apparently precipitated in

the present instance by the inoculation with heated *H. influenzæ suis.* No explanation of the source of the swine influenza virus responsible for these infections was apparent from consideration of the experiments just discussed." The experiments were repeated with similar results without there being any knowledge of the source of the virus. After several experiments to arrive at the source of the virus, the author concludes that " the most likely explanation of the phenomenon seemed to be that the animals, though healthy and susceptible, harboured the virus in some unknown manner."

In the second paper it is shown that the swine lungworm is capable of harbouring swine influenza virus and of transmitting it from swine to swine. Following a series of experiments, the results of which are given in the following summary of the paper, the author states: " It is believed that the puzzling findings described in the preceding paper, in which swine influenza virus infections were elicited in apparently normal swine receiving multiple intramuscular injections of *H. influenzæ suis,* can be explained on the basis of the results recorded in the present paper. The swine used in those experiments were observed to have been infested with lungworms. . . . On this basis masked swine influenza virus present in the lungworms of the swine used is considered to have been accountable for the influenza infections induced."

Summary of the Second Paper.

1. The swine lungworm can serve as intermediate host in transmitting swine influenza virus to swine. The virus is present in a masked non-infective form in the lungworm, however, and, to induce infection, must be rendered active by the application of a provocative stimulus to the swine it infests. Multiple intramuscular injections of *H. influenzæ suis* furnish a means of provoking infection. Swine influenza infections can be provoked in properly prepared swine during the autumn, winter, and spring, but not during the summer. The phenomenon, while not regularly reproducible, occurs in well over half the experiments conducted outside the refractory period of summer. No explanation for the failures is apparent.

2. The virus can persist in its lungworm intermediate host for at least two years.

3. Swine infected with swine influenza virus by way of the lungworm intermediate host exhibit a more pronounced pneumonia of the posterior lobes of the lung than do animals infected intranasally with virus. The situation of the worms providing the virus will account for this.

4. Occasional swine infested with lungworms carrying influenza virus fail to become clinically ill after provocation but instead become immune. In these it is believed that lungworms containing the virus are localised outside the respiratory tract at the time of provocation.

5. It is believed that the experiments described furnish an explanation for the findings recorded in the preceding paper, in which swine influenza virus infections were induced in apparently normal swine by multiple injections of H. *influenzæ suis*.

6. In a single experiment swine lungworms failed to transmit hog cholera virus.

Vaccine Dosage in Canine Distemper. By L. F. WHITNEY. *Vet. Med.* 1941. *XXXVI*, 420.

THIS author has already published an article on "Permanent Distemper Immunization by Vaccine Alone" (*Vet. Med. XXXV*, 408—abstracted *Vet. J. 97*, 72). He has continued his observations and in this article records the results of the use of single doses of vaccine. His conclusions are:—

1. To produce solid immunity against distemper, by the use of vaccine without virus, it is necessary to use fresh vaccine; the older the vaccine the greater the indicated dose.

2. To produce solid immunity it is necessary to grade the dose to the size of the dog. Five to 10 c.c. of ordinary commercial vaccine does not appear to be enough for a large dog. A dose of at least double that amount is suggested.

3. Even small doses of vaccine are decidedly worthwhile as a protective measure, especially if the vaccine be fresh.

4. Of 169 dogs treated by various methods, 86 were solidly immunized, 59 contracted distemper but recovered, and only 24 died. This is in contrast to the controls, of which 107 of 155 dogs died.

5. The use of 0.4 per cent. formalin instead of the usual 0.2 per cent. for attenuation and preservation of the vaccine caused an objectionable degree of local irritation of the site of injection.

Sulfapyridine in the Treatment of Feline Distemper. By A. H. BRYAN. *Vet. Med.* 1941. *XXXVI*, 434.

FOLLOWING on the article by the above author on the use of sulfapyridine in the treatment of canine distemper, a note on the use of the drug in feline distemper has appeared. The note is reproduced in full:—

"Concurrently with observations on the use of sulfapyridine in the treatment of canine distemper and its complications,* a few observations were made on its use in cats suffering from feline distemper. This disease is apparently of virus origin, and complications, particularly of the respiratory tract, frequently develop and lead to a fatal termination.

* Bryan, Arthur H., 1941. Clinical observations on the use of sulfapyridine in the treatment of canine distemper. *Vet. Med.* 36: 7, pp. 365-367.

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"1. Tabby cat, September 15-17, 1940. Age six months. Feline distemper; temperature 104.2 deg. Fahr. Treated with 10 gr. of sulfapyridine a day; recovered in three days, with no untoward sequelæ.

"2. White cat, September 6-10. Bronchial distemper; temperature 103.5 deg. Fahr. Twelve grains of sulfapyridine were administered daily, and recovery was complete in four days.

"3. Siamese cat, August 26-29. Age four months. Mild catarrhal distemper; temperature 103.2 deg. Fahr. Sulfapyridine was administered at the rate of 15 gr. a day. The cat developed a violent reaction to the drug, with face and pendant parts of skin edematous and eyelids swollen nearly shut. The dosage was reduced one-half; the swelling subsided and the cat recovered in three days. The animal had two slight convulsions during treatment.

"4. Alley cat, August 8-11. Age six months. Catarrhal distemper; temperature 103.8 deg. Fahr. Uneventful recovery followed sulfapyridine therapy.

"We have also used sulfapyridine in five recent cases of feline distemper, with equally good results. Since this disease usually runs a protracted course and frequently terminates fatally, the sulfapyridine therapy appears distinctly promising. The drug was administered *per os* in 2½ to 4 gr. doses, three to six times a day. No toxic reactions were observed except in No. 3."

Daily Problems Confronting a Small-Animal Practitioner. By R. E. RUGGLES. *N. Amer. Vet.* 1941. *22*, 292.

THE following short article is reproduced in full. It contains much of interest and value to veterinary surgeons engaged in small-animal practice; the contents being actual experiences and practices of the author.

"There are many and varied ideas as to the duties and qualifications of a small-animal practitioner. Some believe his role to be that of a master of ceremonies, where a smooth tongue handles the situation. Others thinks that it is a white-collar job, where the doctor is in his office from 10.30 a.m. to 4 p.m.—a good thing for an old man who wants to retire and take things easy.

"It is a fact, nevertheless, that small-animal medicine is a rapidly changing field and it has made astounding progress in the past ten years. Many of you know this to be a fact and are familiar with the reasons for it. But, to get to our subject.

"First, I shall discuss conditions common to the region of the head, including the mouth, nose, eyes and ears. Next, I shall touch on subjects involving the body and extremities, and shall close with a discussion of general subjects found in small-animal medicine.

"THE MOUTH.

"*The Teeth.*—These structures form a very important and much neglected part of the dog's anatomy. Dental work makes up an important part of my practice—cleaning and extractions. We are doing more and more of our extractions under local anæsthesia—it is so simple and certainly more humane.

"In scaling teeth, start at the edge of the gum-line and, with a quick motion, chip off the tartar. Heavy accumulations of tartar may be loosened quickly by pressure applied with the extractor. Be very careful to remove all of the tartar, as it is this substance that starts alveolar periostitis and destruction of canine teeth.

"Nerve-blocking is a very simple procedure, especially if you use one of the specially curved needles designed by Dr. D. A. Eastman, although a straight needle will do. The lower arcade may be blocked by carrying the needle on a plane even with the crowns of the first and third molar teeth and slanting slightly toward the middle surface of the mandible to the mandibular foramen. This will require a penetration of about ½-inch to ¾-inch, and then thorough infiltration with any good, local anæsthetic will give the desired effect.

"To block off the upper arcade, you must insert the needle just posterior to the last molar and on a plane passing through the centre of the second premolar tooth. The maxillary alveolar nerve, which is a branch of the infra-orbital nerve, requires a penetration of about ½-inch.

"Knowledge of the anatomy of the teeth will aid greatly in extractions. Remember that each incisor, the canine and the first premolar tooth in the dog have only one root. All other teeth, with the exceptions of the fourth premolar and the first and second upper molars, have two roots. The three teeth mentioned have three roots. All of the teeth with two roots should be split exactly between the two roots to aid in their extraction. The fourth premolar should be split between the two large roots.

"Dental elevators are very useful in removing the upper molar teeth. A rotating motion will aid in loosening the tooth before its actual extraction. A dental chisel is a very important part of dental equipment, for with this instrument you can loosen the adherent gum. This is necessary, especially in the extraction of the molar teeth in order to save gum tears.

"Do not be too anxious to extract the canine teeth. If it is necessary to do this, either use a dental chisel all the way around the canine tooth first, or perform the surgical flap operation before attempting extraction.

"*Stomatitis.*—Severe inflammation of the mouth or pyorrhœa of the gum-line can be checked quickly by using a saturated solution of potassium chlorate as a mouth wash several times a day.

"*Granulomas.*—Malignant or benign granulomas of the gum-line are quite common in older dogs. Usually surgical treatment is rather dangerous because of hæmorrhage, and is only temporary because of metastasis. If the growth

has a small base, ligation and increased tension provide a safe way to remove them.

"*Papillomas.*—The warts that are commonly found in the mouth of the dog are easily removed by clipping them off and cauterising the wounds with an electric cautery.

"*Tonsillitis.*—This condition in dogs can cause a lot of trouble. When examining the tonsils, be sure that the small flap covering each organ is retracted medially for careful observation. Pure cultures of a hæmolytic streptococcus have been isolated from acutely inflamed tonsils. It is not uncommon for us to see a patient appear normal in the morning and then carry a temperature of 105 or 106 within five or six hours. Best results have been obtained in these cases by using neoprontosil, along with cauterisation of the tonsil and local application of a 10 per cent. solution of silver nitrate.

"Frequently, when we mention tonsillitis, clients immediately say: 'Well, a tonsillectomy.' In the first place, do not try to remove an acutely inflamed pair of tonsils, both because of serious hæmorrhage and the danger of systemic infection with a virulent organism. I find that about 80 per cent. of the tonsil cases we treat have only one or two attacks, and then cause no more trouble, while perhaps 20 per cent. remain latent, only to become active later.

"*Epistaxis.*—Nasal hæmorrhage is fairly common and may be quite stubborn. Usually cotton packs or a mild styptic, such as modified Monsel's solution, will take care of the situation. In human medicine some work has been done, using fat salt pork as a nasal plug, on the theory that prothrombin is eliminated and this aids in clotting. I have been afraid to use the fat salt pork, but have used plain fat pork, cutting a tiny ribbon and plugging the nostril with it, and then taping the nostril. Excellent results have been obtained twice on the same dog.

"The Eyes.

"We will have time to discuss only a few of the eye conditions met in small-animal practice.

"*Corneal Ulcers.*—These are very common, especially in Pekingese and Bostons, because of the prominence of the eyes of these breeds. The ulcers are usually caused by trauma, but may follow corneal opacity brought on by severe infections, such as distemper.

"The most minute, pin-point scratch can be detected immediately by staining the eyeball with a 1 per cent. solution of fluorescent dye and then flushing the eye with saline solution or water. The ulcer will be stained green. This is very impressive on the owner, and you can start treatment immediately.

"If the ulcer is large enough to cause bulging at the point of the ulcer, then pressure from the outside must be applied constantly to neutralise intra-ocular pressure. Believe it or not—a many-tailed bandage can be applied to

a Pekingese. A gauze pack and an eye lubricant, such as argyrol ointment, should be applied. As supplementary treatment we use foreign protein (sterile milk) at 48-hour intervals, and neoprontosil in doses of about 9 grains per day.

"*Mydriasis.*—Dilatation of the pupil is a rather common cause of partial blindness in dogs. It usually accompanies some disturbance of the central nervous system, but may be brought on by trauma. Mydriatics seem to have no effect, and the patient must be kept out of strong light. The affected animal cannot see close objects and is continually bumping into things about the house. I know of no good treatment, and the condition is usually permanent, in my experience.

"*Glaucoma.*—This condition has been called dropsy of the eyeball and is fairly common in small-animal practice. It is a filling up of the anterior and posterior chambers of the eye with an excess of lymph, because of stoppage of the canals of Schlemm, which drain to the conjunctiva. Dr. Mason Weadon, of Washington, D.C., has given three good tests for glaucoma :—

"1. The normal eyeball is flexible and very similar to an ordinary soft gelatin capsule, while in glaucoma the ocular globe is as tense and as hard as an apple.

"2. The iris is widely dilated in convoluted folds.

"3. The eyeball is much larger than normal.

"Do not confuse glaucoma with postorbital abscess, which will cause bulging and pain, but the eyeball remains normal in size.

"There are surgical operations to establish drainage at the sclerocorneal junction, but these are quite delicate and it is difficult to control the patient during the healing process. The complete removal of the affected eye is to be preferred, if the other eye is normal in all respects.

"The Ears.

"*Hæmatomas.*—We have developed a method of handling conchal hæmatomas that seems to be far superior to the old suturing methods. The technique of the operation is as follows :—

"1. Shave the inner surface of the affected ear.

"2. Make an incision large enough to allow drainage of the fluid and any clots that may have formed. Usually an incision ¼-inch long is enough. After removing all of the clots, apply a curved piece of sheet aluminium, shaped to fit the ear, and cover this with only one layer of adhesive tape.

"3. Then apply a strip of 2-inch tape, with a small slit in the middle to allow drainage of the ear, and fasten it tightly to the metal splint. Then apply many small strips of adhesive tape to create even pressure.

"4. Next tape the splinted ear to the head.

"5. Open the incision daily at first, to draw out the fluid, and increase the tension by adding more tape.

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"6. In six or seven days, usually the pressure can be released and the splint removed, but the ear must be taped over the head for another week to avoid a recurrence.

"*Otitis.*—Inflammations of the ear make up an important part of my practice. I dislike the word 'canker,' used so freely, as it is such a mysterious word and is commonly used by the layman. In speaking of inflamed ear canals, I would like to see us discard the term 'ear canker' as useless and non-expressive, and call this condition 'otitis' or 'otitis externa.' To me the word 'canker' carries the same mystery that the word 'cancer' does to the layman.

"Otitis is most common in long-eared dogs, but it is found in all breeds. It may be either chronic or acute. Chronic otitis is characterised by:—

"1. Rather permanent swelling of the mucous membrane.

"2. Granulation of the lining of the ear.

"3. Epitheliomata (cauliflower-like growths).

"4. Purulent discharge.

"Acute otitis usually shows the following symptoms:—

"1. Moist or purulent inflammation.

"2. Swelling of the mucous membrane and the canal packed with wax, but dry.

"3. Hyperemia of the mucous membrane.

"In the treatment of otitis, our main problem is first to dry up the secreting membrane, then to reduce the irritation until the epithelial lining returns to normal. In my opinion, it is what we take out of the ear and not what we put into it that really heals this very sensitive membrane. I treat ears with the same principle that I would use in treating an open surface wound, not with healing ointments or powders, but by continually removing the exudate with as little irritation as possible, letting the body do the healing.

"Bear in mind that we can overtreat an ear and change the condition from the acute to the chronic.

"In very moist ears, tape the ear flap over the head to allow the canal to dry. At this stage I do very little probing, but flush the canal with an iron styptic, using an eye-dropper, and being careful to withdraw all fluid that I have put in the canal.

"Check on the progress of the condition by removing heavy exudate with the aid of an open otoscope and an ear speculum. I believe that the open otoscope is indispensable for ear work. Always be sure, when working on the ear, that the patient is held firmly by an assistant.

"I like to treat ears at intervals of 48 hours, at first, to give them a chance to dry and heal. As soon as the ear is dry, it is then a matter of carefully removing the wax and exudate, and using some soothing ointment, such as pellitol, to coat the lining.

"Ear mites can be very quickly destroyed by apply Canex to the ear canals.

"OTHER CONDITIONS.

"*Fight Wounds.*—Unless they are handled correctly at the start, fight wounds may develop into serious conditions. I employ radical treatment from the beginning, dissecting out any subcutaneous fascia which plugs the wound, and then establishing good drainage. By doing this and removing any hair that has been carried into the wound, a long step is taken toward controlling infection.

"*Luxations.*—Although different joints are frequently involved in luxations in the dog, luxation of the head of the femur is perhaps the most common. If this condition is detected immediately, the dog may be given ether and the head of the femur snapped back into place very easily. Restrain the patient until he has completely recovered from the anæsthetic. This gives the muscles an opportunity to contract and hold the femur in place.

"*Posterior Paralysis.*—Various causes contribute to this condition, including injuries to the spinal cord, calcium deficiency, increased pressure of the spinal fluid, and toxæmia resulting from chronic constipation.

"*Fractures.*—Time does not permit of a discussion of the treatment of fractures, so I will merely mention the various types of reduction that are now in use. These include the modified Thomas-Schroeder splint, using aluminium rod; plaster of Paris cast; Castex (Bauer and Black), very useful for fractures in small dogs, where the cast must be light; Stader pins and clamp.

"*Urinary Calculi.*—Either in the bladder or in the urethra of a male, calculi can cause serious trouble. The surest way of making a diagnosis is by means of the fluoroscope or X-ray. If necessary, inflate the bladder with air to get detail. A history of straining and the passing of blood is helpful.

"Cystotomy is the only satisfactory treatment and even then recurrences are quite common. Calculi commonly lodge at the perineal arch of the penis in male dogs, or just posterior to the os penis, in which case surgical entrance into the urethra under morphine and local or general anæsthesia is necessary.

"*Prostatitis.*—This condition is quite common in old male dogs. Abdominal pain, straining, and a mucopurulent discharge from the penis, at times, are common symptoms. Many times pressure from the prostrate gland occludes the urethra. Radical surgery is possible, but castration causing atrophy of the prostate in two to four weeks is much safer and quite effective.

"*Perineal Hernias.*—These are very common, especially in old Bostons. They are usually caused by excessive straining. Surgical reduction does not always prove satisfactory. As a rule, these hernias cause no serious trouble, but at times they fill up, get very tense and occlude the rectum.

" The hernial sac may contain the bladder, forced into the sac by straining; an enlarged prostate gland, or intestines. Nembutal anæsthesia is necessary before such a hernia can be reduced. If the bladder is causing the trouble, a large needle should be inserted through the hernial sac to relieve pressure before reduction.

" *Cæsarean Section.*—I will pass over this operation by saying that I use a median line incision, under morphine and local anæsthesia. This method works very satisfactorily, but the uterus cannot be removed from the body or there will be straining. I follow up all of my obstetrical cases with an ampoule of 1/320 grain of Ergotrate H (ergonovine maleate), and then give the same dosage, in tablet form, every four hours for 48 to 72 hours. This will contract the uterus to normal size while there is still some tone left in the muscles.

" *Bandaging.*—I will close by discussing briefly some types of bandaging used in our hospital. Of course, we use roller bandage and adhesive tape, but wherever possible we cover this with a many-tailed bandage. I use heavy, unbleached muslin for this type of bandage. I do not believe that there is any part of the body that cannot be bandaged with a many-tailed bandage. If the wound or incision is on the top of the back or neck, I tie the knots underneath. If the wounds are on the ventral surface, tie the knots on top of the back, making holes for the front legs.

" I like a many-tailed bandage for use following a cæsarean operation. When the bitch is awake, cut holes in the bandage to accommodate her breasts. I also use this bandage for making a blanket to control scratching in cases of summer eczema. It is also very useful for bandaging ears or eyes.

" Recently veterinarians have made use of sterile gauze bandages that are treated with a special solution which permits cohesiveness between the layers of these bandages. One of these, Gauztex, contains mercuric chloride and it also lends itself well to the bandaging of parts with irregular contour, resulting in a cast-like covering that fits the parts with comfort.

" Stockinette is quite useful in the same manner, for bandaging the head, body or limbs. Muslin boots are quite useful to control scratching.

" Lacroix collars in a variety of sizes are indispensable in small-animal practice, and I prefer them to bandages, whenever possible, as wounds will heal much more quickly if left open.

" Surgical shrouds are very useful and necessary to maintain a sterile surgical field. I like to make them up for permanent use, having them hemmed and laundered.

" Before closing, I would like to stress the importance of dental work. Every new patient is a prospective dental patient and in many cases the teeth are causing more trouble than the condition for which the dog was brought in.

" Remember that healing powders and ointments do not clear up otitis.

Remove the exudate as carefully as possible, and Mother Nature, who has been so kind to all of us, will bring about the healing of the ear canal. At stages, astringent solutions and ointments will assist.

"Let us be a bit more careful and less hasty in making our diagnoses. Many times, observation of a patient for a day will bring out a lot of important facts.

"If you are in general practice and like dogs and cats, then it is only right that you should treat small animals, but do not treat your small-animal patients after your other work has been done. Have a regular time set aside each day or evening, so that you can do your canine practice as carefully as your general practice.

"The treatments outlined for the diseases and conditions covered in this paper are simply our own methods, and I give them to you for what they are worth. I do not claim anything except reasonably good results, and I feel certain that many of you have methods that are better than those to which you have listened. But I do hope that you have picked up something to add to your own way of treating that may help. I claim nothing original, but must say that most of the ideas have been picked up during my internship, in daily practice since then, and through my association with other practitioners."

Studies of Resistance to Pullorum Disease in Chickens. By H. M. DeVolt, G. D. Quigley and T. C. Byerly. *Poultry Science.* 1941. *XX,* 339.

Attention has been directed from time to time to the development of resistance to certain diseases in animals. Inheritance to resistance and susceptibility to pullorum disease in the domestic fowl has been studied by several observers, especially in America. This article deals with six experiments, from the results of which the following conclusions are drawn:—

".(1) Strains of relatively pullorum-resistant chickens may be developed by artificial selection. (2) Strains of relatively resistant chickens develop by natural selection in the presence of natural infection. (3) Pullorum clean flocks produced chicks which were relatively susceptible to pullorum induced by artificial exposure. (4) Under the conditions of these experiments the pullorum-resistance encountered was of a relatively low order. (5) The existing data indicate that the development of pullorum-resistant strains is not now a satisfactory substitute for control and eradication programmes by agglutination tests."

Tuberculosis in Atypical Hosts. By J. A. Baker and W. A. Hagan. *Cornell Vet.* 1941. *XXXI,* 301.

The following note is reproduced in full:—

"Most domestic animals other than the usual hosts show considerable resistance to tubercle bacilli. As Griffiths* points out, when these organisms

*Griffiths, A. S.—A System of Bacteriology in Relation to Medicine. Medical Research Council of Gt. Britain. 1930. *5,* 289.

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do occasion disease in unusual hosts, they frequently become altered in their pathogenicity for the normal hosts and for experimental animals. In the unusual host the lesions often are atypical. The pathological picture frequently is that of proliferative changes resembling fibroblastic tumours, and a definite differential diagnosis may require the demonstration of tubercle bacilli.

" Within the last three years, tubercle bacilli have been studied from three unusual hosts. In two instances, the sources were horses; in the third, a mink. In all three cases tissues were received by the laboratory for diagnosis. Tubercle bacilli were demonstrated by direct smears in all instances, and cultures were obtained from each and subjected to the usual typing tests to establish their identity. The cultures were isolated from guinea pigs inoculated with the infected tissues of one of the horses and of the mink. In the case of the other horse, the culture was isolated directly from the lesion.

" In all three cases, the acid-fast organism, seen in smears made directly from the lesions, was rather short and thick. In all instances the organism developed in primary cultures on plain egg medium but not on the glycerolated. On coagulated bovine serum medium the growth was meagre and slow in developing (dysgonic type). All three strains produced tuberculosis in rabbits and guinea pigs but failed in chickens. Tests on infected guinea pigs showed that all of the strains produced sharp skin sensitization to mammalian tuberculin but none to the avian type. The mink strain and one of the horse strains were highly pathogenic, producing generalised tuberculosis in both rabbits and guinea pigs from which the animals died in about two months. The other strain from a horse was markedly attenuated, since it produced only local lesions at the point of injection in rabbits and local lesions with involvement of the neighbouring lymph nodes in guinea pigs.

" The evidence indicates that, in the instances described, the infecting organisms were tubercle bacilli of the bovine type. Tuberculosis of the horse is not so rare in areas where bovine tuberculosis is prevalent as it is commonly believed. Now that the bovine disease is becoming something of a rarity in this country, the possibility of retention of the infection on premises in old horses is something worth keeping in mind when ' breaks ' occur. From the experiences of many, both in this country and abroad, tuberculosis in horses is almost invariably caused by infection with the bovine type. Tuberculosis in the mink, however, is probably rather rare. We have seen no reports of other cases."

Tetanus in the Dog. By J. R. WEST. *Canad. J. Comp. Med.* 1941. *5,* 149.
Canine Tetanus. By C. C. COLLINS. *Vet. Med.* 1941. *XXXVI,* 434.

THE first article refers to a cocker spaniel weighing about 20 lbs. The

animal had been in a motor car accident and had a large semi-circular tear in the right hip. Little hæmorrhage was present nor had much contamination of the wound taken place. Following anæsthesia (morphine and a local anæsthetic) the wound was cleansed and three catgut sutures were inserted, drainage being allowed for. Five days later the dog refused food and vomited a yellowish frothy material. A small portion of dead tissue was removed from within the wound. Temperature and respirations were normal. "A very noticeable feature, however, was a contraction of the pupils with a slight elevation of the membrana nictitans and quite a distinct elevation of the upper eyelid; the whole giving the appearance of the forehead skin being pulled back." The vomition could not be controlled. The condition became worse till on the eighth day "the muscular movements became stiff, the jaws could be opened only about one inch . . . the lips were drawn back slightly over the teeth, a very constant feature of tetanus in the dog. On the ninth day the back was slightly arched and rigidity of the muscles was quite marked. Nervous reflex to sound and touch became evident and the first tetanic spasm occurred." The dog was then destroyed. The author points out that "this case emphasises that tetanus in the dog as in other animals may result from comparatively trivial wounds."

The second article concerns a three-year-old female Boston terrier. The dog has been sick for several days, a peculiar stiffness and loss of appetite being the symptoms observed. On examination an increased reflex excitability was noticed; pulse, respirations and temperature were normal. There was extension of the limbs with the head drawn backwards and the facial expression was distorted with the mouth commissures drawn backward and the forehead wrinkled. The eyeballs were slightly protruded and the nictitating membranes were prolapsed. There was grinding of the teeth. The history given by the author was that the bitch had been in a fight with a sow several weeks previously and had several "small scratches." No open wounds were found. The case was treated with nembutal intravenously, "to relax the body musculature," and 10,000 units tetanus antitoxin subcutaneously. "The dog was placed in a cage in a quiet spot. The following day 5,000 units of tetanus antitoxin was given subcutaneously, and glucose and physiological saline solution intravenously. The third day the dog received 5,000 units of tetanus antitoxin subcutaneously and was fed a small quantity of milk and ground beef, the food being placed on a box to enable her to gain access to it. Some relaxation of the rear parts was noted. The fourth day, relaxation was still more marked, the dog's appetite was better and treatment was discontinued. The sixth day, the dog was still stiff, but her general condition warranted discharge from the hospital." When seen in two weeks, all symptoms had disappeared.

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Some Differential Diagnostic Problems Concerning the Pathologic-anatomical Demonstration of Tuberculosis. By H. E. OTTOSEN. *Skan. Vet.-Tidskft.* 1941. *XXXI*, 257.

THIS is a long and interesting article. The opening section and the summary are reproduced in full. The remainder of the article deals in detail with a variety of pathological conditions which might be confused with tuberculous lesions unless care is taken in diagnosis.

"Gradually, as the eradication of tuberculosis in our domestic animals is progressing, we become more aware of some problems that have existed, it is true, as long as the combating of tuberculosis has been going on, but have not been recognised until now when the frequency of this disease is decreasing markedly. Take, for instance, the infection with the avian type of the tubercle bacillus, which was encountered even in the early days of the combating of tuberculosis and still gives rise to a good deal of trouble in the work with the tuberculin tests. Further, in recent years, with the great increase in the number of tuberculosis-free herds, we have had to recognise the not unessential significance of bovine tuberculosis in man as a cause of new infections in tuberculosis-free herds. Likewise, infections with the human type in cattle are rightly attracting an increasing attention as the cause of tuberculin sensitivity in otherwise healthy cattle.

"With the progressing combating of tuberculosis in fowls, moreover, we will have to pay more attention to the possibility of infection from wild birds when we are dealing with infections of mammals with the avian type.

"These problems then are connected with the protection of tuberculosis-free herds against new infections, but they also involve the differential diagnosis. The examples of the latter category cited so far concern the work with tuberculin tests, and every new problem of this kind will increase the demands made upon the knowledge and thoughtfulness of the practising veterinary surgeon.

"But these problems concern also the meat inspectors, as the decreasing frequency of tuberculosis will increase the demands made on the watchfulness and pathologic-anatomical knowledge of these veterinary officers.

"As long as the sanitary requirements are met, of course, it does not make a great deal of difference whether a slaughtered animal, coming from a tuberculous milieu, is condemned or marked down for tuberculosis or some other affection. This is not the case, however, if the animal comes from a positively tuberculosis-free milieu, as neither the owner nor his veterinarian will be able to understand where the tuberculosis infection might have originated from; besides, to the owner it may mean a serious financial loss to have his otherwise 'pure' herd stamped as being tuberculous.

"The now so well-known corynebacterial processes in the cervical lymph glands of swine ('Holth processes') afford a striking illustration of a lesion

which in numerous cases has been designated wrongly as tuberculosis, while nowadays we are able with a fair degree of certainty to differentiate them from tuberculous processes (at any rate we have at our disposal the means for such a differentiation).

" But also other lesions may give rise to mistaken diagnosis—or at any rate suspicions of tuberculosis. Discussing this question, Ostertag* says that, in particular, caseated echinococci, processes produced by *Linguatula* and *Distoma* larvæ, besides actinomycosis, may give rise to mistakes for tuberculosis; but also simple suppurative processes, tumours, leukemic infiltrations, etc., may occasionally give rise to such mistakes.

" In recent years, here in the State Veterinary Serum Institute, we have collected a number of specimens—mostly true tumours—that have been mistaken for tuberculosis, or suspected of tuberculous nature. It is only fair to state, however, that only a few of these cases had been considered by the inspecting veterinarians to be positively of tuberculous origin, and even in these cases there were some features that had attracted the particular attention of the veterinarian and caused him to send the specimen to this laboratory for further examination. But, of course, this does not exclude the possibility that several similar cases simply have been regarded as tuberculous. It is on the background of this possibility that a fairly detailed description will be given here of some of the specimens we have received for examination.

" SUMMARY.

" As in a rapidly progressing combating of tuberculosis in domestic animals it is very unfortunate if tuberculosis is diagnosed erroneously on autopsy or in the meat inspection, the author has here described a number of cases of various pathological conditions that have been mistaken for, or suspected of, being tuberculous.

" First, a description is given of some cases of tumour formation :—

" 1. Adenocarcinoma of the bladder with lymphogenous extension to the uterus and implantation metastases on the peritoneum and pleura.

" 2. Multiple adenocarcinomata of the peritoneum. Primary tumour not observed.

" 3. Multiple adenocarcinomata of the peritoneum and pleura, also of the liver, besides a large tumour mass under the posterior, dorsal vertebræ. Site of the primary tumour unknown.

" 4. Multiple congenital adenocarcinomata of the peritoneum in a calf, a few days old. Primary tumour not demonstrable.

" 5. Multiple squamous cell carcinomata of the lungs, liver, regional lymph glands and peritoneum. Pimary tumour not observed (in the first stomachs?).

" 6. Hemangio-endothelioma under the vertebral column, with ingrowth

* R. von Ostertag: *Lehrbuch d. Schlachtvieh- u. Fleischbeschau*, 1932, p. 688.

in the spinal canal and compression of the spinal cord. Clinical suspicion of tuberculosis of the vertebral column or of the meninges of the spinal cord.

"7. Round-cell sarcoma of the lungs and corresponding processes on serous membranes.

"8. Multiple spindle-cell sarcomata of the lungs and mediastinal lymph glands.

"9. Multiple hemangio-endotheliomata of the lungs.

"In all these cases (the first eight of which occurred in cattle, and the last one in a horse) it was impossible without bacteriological and histological examinations to decide whether or not the morbid processes were of tuberculous nature.

"In addition, description is given of some nodules or nodes arising in cattle after injection of vaccine against foot-and-mouth disease, now and then suspected of being tuberculous, inoculated through the injection of vaccine. These nodules are built like markedly hyperplastic lymph glands; most often they contain more or less extensive areas of necrosis, sometimes also abscesses. Their origin is attributed to the formaldehyde content of the vaccine.

"Finally, mention is made of two cases of multiple unspecific miliary abscesses and one case of pulmonary actinomycosis in cattle, one case of ateroma of the vulva in a heifer, one case of multiple abscesses of mesenteric lymph glands, liver, spleen and stomach in swine, and one case of nephrolithiasis in a cow due to the formation of miliary nodules in the renal cortex. In all these cases the morbid processes had been taken to be of tuberculous nature."

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